Bangladesh J. Agri. 2025, 50(1): 106-116 *DOI: https://doi.org/10.3329/bjagri.v50i1.82946*

PRODUCTION, NUTRITIONAL EVALUATION OF JACKFRUIT JAM AND DEVELOPMENT OF NEW PRODUCT BY USING JACKFRUIT JAM

M. M. Rahman[1*], S. M. F. Jinnah[2] and S. A. Rahman[1]

[1]Deptartment of Applied Nutrition and Food Technology, Islamic University (IU), Kushtia;
[2]Department of Applied Chemistry and Chemical Technology, Chattogram Veterinary and Animal Sciences University (CVASU), Chattogram. Bangladesh.

Abstract

To produce and characterize jackfruit (*Artocarpus heterophyllus*) jam by the extraction of pulps from collected jackfruits was conducted June to December in 2019 at Department of Applied Chemistry and Chemical Technology, Chittagong Veterinary and Animal Sciences University, Khulshi-4225, Chattogram, Bangladesh. Pre-prepared lemon juice, ascorbic acid, pectin, color, citric acid, potassium metabisulfite, and sugar were added to the pulp. After heating and stirring, the mixture reached a 69% brix sugar content and appropriate consistency. Cake making used wheat flour, xanthan gum, caster sugar, salt and other food grade ingredients. Freshly made jam was injected into the cake to make a jackfruit jam cake. Protein (3.80%), carbohydrate (17.83%), ash (0.60%), crude fat (1.90%), crude fiber (0.95%), moisture content (74.89%), pH (5.20), vitamin C (6.23 mg/100g), and total acidity (0.07 g/100g) were found in fresh jackfruit. On the other hand, protein was 3.40% and carbohydrate 59.97% in prepared jackfruit jam. The crude fat content was 1.97% and the ash 0.45%. Jam moisture was 33.40% and crude fiber was 0.80%. The jam also had 13 mg of vitamin C per 100g. The jam's pH was 3.80 and its total acidity 0.43 g per 100g. A sensory and general acceptance test was performed on 10 untrained individuals. The tester used a 7-point hedonic scale to compare the jam cake to a commercial cake. Jackfruit and commercial mango jam differed in color, taste, and sweetness, according to testing. There was significant variation in hedonic scores between the four groups ($p<0.05$). This study reveals that jackfruit has high sensory qualities, making it appropriate for jams and other processed foods and increasing its market value.

Keyword: Cake, Jackfruit, Jam, Mineral, Proximate composition.

Introduction

The jackfruit (*Artocarpus heterophyllusLam.*) is the largest tree fruit belongs to Moraceae family. It may weigh up to 50 kg and be 60–90 cm long. There exist two primary types of jackfruit, the first type of jackfruit is small, fibrous, squishy, and mushy, with carpels that taste sweet like raw oysters. The second type is crisp and crunchy taste lacks sweetness. Despite its difficult digestion, this non-leguminous plant's seeds are edible (Siddappa, 1957). The seed's white aril encloses a thin brown spermoderm and a succulent

* Corresponding author: hmmrmahfuz111@gmail.com

white cotyledon. The cotyledons of the jackfruit exhibit a notable abundance of carbohydrate and protein content (Singh et al., 1991). Among the fruits cultivated in Bangladesh, the jackfruit has the third position in terms of area under cultivation and the second position in terms of output. A total land area of 17981.8 acres is dedicated to the cultivation of jackfruit, resulting in an annual production of 145316.82 M. tons in the nation (BBS, 2023). Jackfruit contains vitamin A, C, thiamin, riboflavin, calcium, potassium, iron, sodium, zinc, and niacin. Jackfruit has 94 calories per 100g. (Mukprasirt and Sajjaanantakul, 2004) The potassium content of jackfruit is 303 mg per 100 g. Jackfruit is a good source of vitamin C, an antioxidant and maintains oral health (Jagtap *et al.*, 2010). The processing of jackfruit into a pureed form allows for its utilization in several applications, including baby food, juice, jam, jelly, and as the basis for cordials (Susanta K. Roy and G. D. Joshi, 1995). The ripe perianth of the jackfruit yields around 2 MJ of energy per kg. The seeds of the jackfruit include a significant quantity of starch.(Singh *et al.*, 1991)Mature jackfruits are used in vegetable-based curries and salads. Ripe fruits may be eaten raw or cooked with creamy coconut milk to make a delicious dessert. Jackfruits are used to make desserts, fruit-rolls, marmalades, and ice cream. Freeze-drying, vacuum-frying, and cryogenic processing are new ways to preserve jackfruit-derived products. Several jackfruit tree components are used in medicine, and its wood is valued in the timber industry (Susanta K. Roy and G. D. Joshi, 1995).The bulbs (except the seeds) provide high sugar, moderate carotene, and vitamin C (Bhatia et al., 1955). Due to limited postharvest skill in harvesting, shipping, and storage, both quality and quantity of jackfruit, especially during glut season (June-July), is squandered every year. Therefore, postharvest technology must be used to enhance shelf life. The pulp and juice of a single fruit, including the whole fruit, are used to make jam. Boiling and gelling fruit and packing it for long-term storage is called "fruit preserves". These preserves are used in toast spreads, fillings, and jellies. Good jam is smooth and free of fruit pieces. It has a vivid color, delicious taste, and a semi-gelled consistency that spreads easily without extra liquid (NC *et al.*, 2014). The presence of pectin in jackfruit renders it a suitable candidate for the production of jam. As such the objective is to create a novel food product utilizing jackfruit jam that is well-suited for large-scale manufacturing.

Materials and Methods

The study was conducted from June to December in 2019 at Department of Applied Chemistry and Chemical Technology, Chittagong Veterinary and Animal Sciences University, Khulshi-4225, Chattogram, Bangladesh. The process of product development and subsequent laboratory analysis was conducted at the Department of Applied Chemistry and Chemical Technology and Food Processing and Engineering CVASU, Chittagong, Bangladesh as well as Dept. Of Applied Nutrition and Food Technology, IU, Kushtia-7003, Bangladesh. The entire study was divided into three major categories: production of jackfruit jam, nutritional evaluation of jackfruit jam and jackfruit, to develop a new variety food product by using jackfruit jam and shelf-life observation. Three fresh ripe jackfruits (*Artocarpus heterophyllus Lam*) were purchased from Reazuddin Bazar, New Market, Chattogram in June 2019. Sugar, Flour, Whole Egg, Oil, Lemons, Plastic Basin, Muslin Cloth commercial mango jam and Sieves were all purchased from Khulshi Mart, West Khulshi, Chattogram. Jam bottles were purchased

from RFL plastic, Pahartoli, Chattogram. Cake Gel (Finagel),Cake Mix(Foster Clark's), Glycerin(Sigma-Aldrich), Sorbitol (Spicy World), Vanilla Flavor(Foster Clark's), SAPP, SBC(Foster Clark's), Liquid Glucose, Potassium Sorbet (Purix), Citric Acid (LD Carlson), Ascorbic Acid (Scharlab), Pectin & Color were purchased from HS Scientific, Hatkhola, Dhaka.

Crude protein, moisture content, dietary fiber, crude fat, ash content, carbohydrate, minerals content, vitamin C, pH, total titratable acidity were determined of jackfruit and jackfruit jam. A new variety food product was developed by using jackfruit jam. In this study jackfruit jam cake was developed and prepared jack-fruit jam was observed the shelf life about three months. The study employed a Complete Randomized Design (CRD) using the Statistical Package for the Social Sciences (SPSS) software.

Jam preparation

The fresh and ripe jackfruits were thoroughly washed with tap water to remove dirt. Then, the jackfruits were sliced diagonally to separate the new bulbs from the seeds and other unwanted parts. Jackfruit bulbs, weighing 4.128 kg, were boiled in 3 liters of water for 10 minutes. This technique softened the mixture for simpler homogeneity. The mixture was blended with a fruit grinder after boiling. The mixture was sieved with a 2mm mesh sieve. After quantifying jackfruit pulp, it weighed 7 kg. Pulp was mixed with 3.769 kg sugar and 10 ml lemon juice. Lemon juice added acidity to lower the pH and boost pectin in the jam. The following equation determined how much sugar was needed in the fruit pulp to make jam:

$$Sugar\ to\ added = \frac{TSS(Final) - TSS(Pulp)}{100} \times W$$

Where, TSS (final) - is the preferred sugar concentration for jam production, which is 69%; TSS (pulp) - pulp sugar level and W- utilized pulp weight (in grams).

The juice combination underwent the process of cooking on a gas cooker until the brix level reached 69^0. In the cooking time 15 gram citric acid, 15 gram pectin, 5 gram ascorbic acid, 0.5 gram egg yellow color and 5 gram potassium metabisulfite was added for the production of jackfruit jam. Subsequently, the heated jam was carefully transferred into sterilized containers, securely sealed with lids, and allowed to cool naturally to ambient temperature (Molla *et al.*, 2011).

Cake preparation

Before making the cake, Custer Sugar 26.01%, Common salt 0.193%, and Whole egg 14.86% were combined in the mixer for 10 minutes at high speed. Xanthan gum 0.119%, liquid glucose 1.13%, potassium sorbet 0.595%, cake mix 1.486%, cake gel 0.446%, glycerin 1.486%, sorbitol 0.743%, vanilla flavor 0.193%, and cold water 7.40% were added to the mixer and mixed for 10 minutes at high speed. Wheat flour 31.51% (Gluten 8-9%), Sodium acid phosphate 0.312%, Sodium bicarbonate 0.104%, and Palm oil 13.38% were added to the mixer and mixed for 1 minute at medium speed. The specific gravity ranged from 0.55 to 0.65. For 30 minutes, the tunnel oven cooked the cake batter at 180 degrees Celsius. After baking, cake chilled for 20 minutes. Finally, cake was taken

from cup and kept at room temperature. The injector filled jackfruit jam into the cake after preparation. Then jackfruit jam cake was packaged.

Determination of Crude Protein (CP): The macro Kjeldahl method, per AOAC 920.87, was used to measure crude protein in fresh jackfruit and jackfruit jam. 1 g of each sample and a blank were put in a 100 mL Kjeldahl digestion tube. 2 g of Kjeldahl catalyst and five ml of conc. sulphuric acid were added to each tube. The materials were digested to generate a blue solution. The digestion process was prolonged to release nitrogen from the heterocyclic ring. After chilling the digest, 20 ml of distilled water was added to dissolve it. The diluted solution was macro-distilled using the Kjeltec^{TM}8200 Auto Distillation Unit (2012). To increase ammonia release, 50 ml of 40% sodium hydroxide solution was added to the digest. Ammonia was extracted by steam distillation and collected in a 50 ml flask with 4% boric acid. Using bromocresol green and methyl red as indicators, the distillate was titrated with 0.1520 N HCl.

The nitrogen content was calculated using the formula:

$$\%\ Nitrogen = \frac{(Titre\ blank)\ in\ ml \times Conc.of\ acid\ N/mol}{Weight\ of\ sample\ (gm)} \times 100$$

The following calculation uses factor 6.25, the nitrogen percentage, to calculate plant protein content:

$$\%\ CP = \%N \times Gbdups\ (6.25)$$

Determination of Moisture Content: Method number 925.09 from the AOAC (1995) standards measured the moisture content of fresh jackfruit and jam.(AOAC, 1995) Each sample was weighed in the crucible at around 2 g. The specimen was equally dispersed in the crucible and dried in a 105ºC oven for 48 hours. After that, the specimen was carefully placed in a desiccator to cool. Crucibles were reweighed. The formula below calculated the percentage of moisture content:

$$\%\ Moisture\ Content = \frac{W1-W2}{W1} \times 100$$

Whereby;

W_1 is the sample's original weight in gram before drying, and W_2 is its final weight.

Determination of Dietary Fiber: The dietary fiber content of fresh jackfruit and jackfruit jam was measured using method 920.86. 1 g of each sample was extracted to determine crude fiber content using the Fibertec^{TM}1020 FOSS model 2012. After 30 minutes with dilute H_2SO_4 (0.125M), the samples were digested with hot water. After 30 minutes of digestion with diluted alkali (0.125M KOH), the leftover product was rinsed three times with hot water. The leftover material was desiccated in an oven for 5 hours, cooled, and weighed. The leftover material was incinerated at 525°C for 2 hours in a muffle furnace. After incineration, the material cooled and was weighed again. The equation was used to calculate fiber content:

$$\%\ Crude\ Fibre = \frac{W1(g)-W2(g)}{W1(g)} \times 100$$

Where;

W1 and W2 are the sample residue's weights (g) before and after incineration.

Additionally, the dry sample for determination (W) is weighed (g).

Determination of Crude Fat: Fresh jackfruit and jackfruit jam crude fat content was measured using Soxtec System AOAC (1995) method 920.65, which entailed ether extraction.(AOAC, 1995) About 6 g of pre-dried materials were measured and placed in an extraction thimble. Thimbles were wrapped in fat-free cotton and placed in the Soxtec device's midsection. After drying and weighing the cups, 60 ml of petroleum ether petroleum spirit (40-60ºC) was added. It took around an hour to remove the cups in the Soxtec extractor. After extraction, the fat extract cups were dried in a 105oC oven for 30 minutes. After cooling in desiccators for 30 minutes, the cups were weighed. Crude fat % was calculated using an equation:

$$\% \, Crude \, Fat = \frac{\boldsymbol{Weight \, of \, Crude \, Fat(gm)}}{\boldsymbol{Weight \, of \, Dry \, Sample(gm)}} \times \mathbf{100}$$

Determination of Ash Content: Ash content was measured in fresh jackfruit and jackfruit jam samples using a muffle furnace according to AOAC standard method 923.03.(AOAC, 1995) About 5 g of each sample were placed in triplicate in a pre-weighed crucible and dried in a 105ºC oven for 48 hours. The dried samples were weighed and heated in a muffle furnace at 550º Celsius for 3 hours to generate a white or grey ash residue. After desiccating the samples to ambient temperature, their weights were assessed. Ash % was calculated using this equation:

$$\% \, Ash \, Content = \frac{\boldsymbol{Weight \, of \, Ash(gm)}}{\boldsymbol{Weight \, of \, Sample(gm)}} \times \mathbf{100}$$

Determination of Carbohydrate (CHO): According to the Association of Official Analytical Chemists (AOAC, 1995), fresh jackfruit and jam have different carbohydrate content percentages.(AOAC, 1995) This equation shows the formula:

%CHO = 100 -(%Protein+%Moisture+%Crude fat %+Crude fiber+% Ash content)

Determination of Minerals Content: The Unicam 919 Atomic Absorption Spectrophotometer was used to assess fresh jackfruit and jam for minerals, under AOAC (1995) Official technique number 968.08.(AOAC, 1995) The test parts were dried and ashed at 450°C, rising by 50°C each hour. Association of Official Analytical Chemists (AOAC, 1995) method was used to analyze mineralized ash. The ash sample was dissolved in 20 ml of 1N hydrochloric acid (HCl) and heated at 70°C for 5 minutes. The solute was then accurately transferred to a 100-ml volumetric flask and filled with distilled water to capacity. Calcium, sodium, iron, zinc, and potassium were measured using the Atomic Absorption Spectrophotometer technique in technique 968.08. After preparation, the samples were taken to the Bangladesh Council of Scientific and Industrial Research (BCSIR) lab in Dhaka. Absorbance was measured for sample and reference solutions. A standard curve graphic showed the connection between absorbance and standard solution concentration to calculate mineral content in unknown materials. Following the equation, the concentrations were represented.

$$\% \, Mineral \, Content \, mg/100gm = \frac{\boldsymbol{R \times Extract \, volume \, (l)}}{\boldsymbol{S \, (kg)}} \times \mathbf{100}$$

Where,

R = The mineral concentration in ppm or mg/Kg calculated using a linear regression formula, D.F = Dilution Factor and S = sample weight (Kg)

Determination of itamin C

Vitamin C concentration in fresh jackfruit bulb and jam was measured using the 2, 6-Dichlorophenol indophenols (DCIP) sodium salt, following method 967.21.This experiment used a phosphoric acid/acetic acid solution to ensure the right acidity (pH 1-3) and prevent acid oxidation. Two 5g samples of pulverized jackfruit and jam were put in 250ml Erlenmeyer flasks. Orthophosphoric acid (50 mL) was added to the extraction procedure to lower pH and remove proteins. After filtering, the extracted samples were titrated with standardized Dichlorophenol indophenols until they became pink, indicating reduction. Dichlorophenol indophenol volume was used to calculate vitamin C levels in samples using a particular calculation:

$$Mg\ of\ Ascorbic\ Acid = (X\text{-}B) \times (V/Y) \times (F/E)$$

Where,

X=titrate value, B= blank, V = initial assay solution volume, Y=volume of sample aliquot titrated. F=Amount of ascorbic acid equivalent to 1.0 milliliter of indophenols (mg) and E = number of ml assayed.

Determination of Total Titratable Acidity: Total titratable acidity (TTA) was determined in jackfruit pulp and jam using the AOAC (1995) method 942.15 and 920.49 standard procedures.(AOAC, 1995) 0.1 M NaOH standard solution was titrated against a 5 ml sample of diluted jackfruit pulp and jam diluted to 250 ml with hot water. AOAC (2000) recommended titrating with 0.3 ml of phenolphthalein indicator per 100 ml of solution until a pink end point lasted 30 seconds. The following equation calculated reported acidity in milliliters of 0.1N NaOH per 100 ml:

$$Total\ Titratable\ Acidity\ gm/100gm = \frac{\boldsymbol{Titrate\ Volume \times N}}{\boldsymbol{Sample\ Weight}} \times \mathbf{100}$$

Where, N represents the normality of the alkali solution used.

Determination of pH: The pH of a solution is defined as the logarithm, to the base 10, of the reciprocal of the hydrogen ion activity in the solution (McClements & Decker, 2009). P^H is the most important parameter for food product quality and safety control. The pH measurement of aqueous solutions was conducted using a glass electrode included in a pH meter (HI2210).

Sensory Evaluation for Jackfruit Jam and Jam Cake: Developed jam and control jam as well as developed jam cake and commercial cake as control cake samples were subjected to sensory evaluation using a 7-point hedonic scale ranging (1= dislike very much, 2=Dislike moderately, 3=Dislike slightly, 4=Neither like nor-dislike, 5=Like slightly, 6=Like moderately, 7=Like very much). Ten consumer panelist members were selected randomly where commercial mango jam was used as a control. The jam samples were evaluated for color, texture, flavor, taste, spreadability, sweetness, and overall acceptability. In contrast, cake evaluations included appearance, taste, texture, mouth feel,

sweetness, flavor, and overall acceptance.

Yeast and mold count of Jackfruit Jam: Yeast and mold (CFU) were counted initially and at the end of the storage period using standard plate count (SPC) method. Potato Dextrose Agar Media was used by pour plate method (Rana et al., 2021).

ANOVA was performed to investigate the mean hedonic score of overall acceptability among the developed jam cake, commercial cake, jackfruit jam and commercial mango jam. Independent t- test also performed to investigate the mean hedonic score of all sensory attributes separately between jackfruit jam and commercial mango jam as well as jackfruit jam cake and commercial cake by IBM SPSS windows version 21.

Results and Discussion

Proximate composition of Jackfruit and Jackfruit Jam Table 1 shows the comparison of Jackfruit and jam. The raw jackfruit has 17.83% carbohydrate, whereas the jam had 59.97%. Since processed carbs have less moisture than unprocessed ones. This study was found a little resemblance to another previous research, which found 13.92, 30.90, and 48.48% for fresh jackfruit, jackfruit jam, and pineapple jam (Eke-Ejiofor & Owuno, 2013). Sugar contributes to jams' high carbohydrate content. Fresh jackfruit has 74.89% moisture, whereas jam has 33.40%. The jam had the lowest moisture level. Sugar and heat during jam-making evaporate moisture, resulting in a moisture difference between processed and untreated jackfruit. Eke-Ejiofor and Owuno was found 24.60% moisture in jackfruit jam, 23.29% in pineapple jam, and 73.60% in fresh jackfruit. According to the Food and Agriculture Organization (FAO) and World Food Programme (WFP), jam made from stone fruits including apricots, peaches, and others had 29.6% moisture in 1970. The investigation was found that fresh jackfruit had 3.80% protein and jackfruit jam 3.40%. Fresh jackfruit has 1.90% fat, whereas jam had 1.97%. Fresh jackfruit contained slightly more fat than strawberry, blueberry, and grape jams, which had 0.01% to 0.03% fat (Naeem *et al.,* 2017). This implies jackfruit jam is low in fat also found that both jam and fresh jackfruit samples, which is good for weight loss and health. The ash percentage in jackfruit jam was 0.45%, whereas fresh jackfruit was 0.60%. This investigation confirms Eke-Ejiofor and Owuno (2013) findings on jackfruit jam (0.27%) and fresh jackfruit (0.43%) (Eke-Ejiofor and Owuno, 2013). Haque *et al.* (2009) also found ash amounts in fresh fruits between 0.053% to 0.902%.Fresh jackfruit has 0.95% crude fiber. Fresh jackfruit and jam had pH readings of 5.20 and 3.80, respectively. Fresh jackfruit, jackfruit jam, and pineapple jam have pH values of 5.57, 3.36, and 3.35, respectively, according to previous findings.(J, 2013) Jam pH is crucial to gel consistency. Low food pH inhibits microbiological growth. Fresh jackfruit has 0.07 g/100g of titratable acidity, whereas jam has 0.43. The addition of lemon juice and citric acid during jam-making increased its acidity. High acidity in processed foods indicates long storage. Acidity is also important for jam equilibrium. The research showed 23.70% TSS in fresh jackfruit which was 69.0% higher in processed jackfruit jam. Fresh jackfruit has a brix value of 23%, whereas jam had 40%.(Eke-Ejiofor, 2013)The vitamin C level of fresh jackfruit was 6.23 mg per 100 grams, whereas jackfruit jam was 13.00 mg. The combination of lemon juice and ascorbic acid during jam preparation was expected to increase vitamin C content. Goswami *et al.* (2011) was found vitamin C values of 8.18- 4.57 mg/100g in fresh jackfruit from different varieties. The

Jackfruit jam included calcium (29.57 mg/100g), sodium (6.98 mg/100g), potassium (256.72 mg/100g), zinc (0.21 mg/100g), and iron (0.31 mg/100g). The difference in mineral contents between fresh jackfruit and jam may be due to processing.

Table 1. Proximate Nutrient Composition of Jackfruit and Jackfruit Jam per 100 gm

Nutrients	Jackfruit	Jackfruit jam
Moisture (gm)	74.89	33.40
Crude protein (gm)	3.8	3.40
Crude fiber (gm)	0.95	0.80
Ash content (gm)	0.60	0.45
Crude fat (gm)	1.90	1.97
Carbohydrate (gm)	17.83	59.97
TSS (gm)	23.70	69.00
Total Titratable Acidity (gm)	0.07	0.43
P^H	5.20	3.80
Vitamin C (mg)	6.23	13.00
Calcium (mg)	30.87	29.57
Sodium (mg)	8.34	6.98
Iron (mg)	0.54	0.31
Zinc (mg)	0.32	0.21
Potassium (mg)	259.14	256.72

Sensory Evaluation for Jackfruit Jam and Jam-Cake: One-way ANOVA was performed to investigate the mean hedonic score of overall acceptability between groups. There was a statistically significant difference at the $p<0.05$ level in hedonic scores for the four groups: $F(3, 36) = 6.62$, $p=0.001$. Post-hoc comparisons using the Tukey HSD indicated that the mean hedonic score for jackfruit jam (M=5.9, SD=0.73), Commercial mango jam (M=5.0, SD=0.66), jackfruit jam-cake (M=6.1, SD=0.73) and commercial cake (M=5.2, SD=0.42). Independent t- test was used to investigate the statistically significant difference of mean hedonic scores of various sensory attributes between groups, individually. The mean differences of color $t(18)=3$, $p=0.001$; aroma $t(18)=2.27$, $p=0.035$; taste $t(18)=2.4$, $p=0.025$were found significantly high in developed jackfruit jam than the commercial mango jam but spreadability $t(18)=1.34$, $p=.19$; sweetness $t(18)=1.1$, $p=0.27$; and texture $t(18)=1.15$, $p=0.26$were not significantly different between jack-fruit jam and commercial mango-jam as well as the mean value of appearance $t(18)=2.3$, $p=0.03$; aroma $t(18)=2.1$, $p=0.04$; taste $t(18)=2.7$, $p=.01$; were also found significantly high in Jackfruit jam-cake than the commercial cake, on the other hand mouthful $t(18)=1.34$, $p=0.19$; sweetness $t(18)=1.3$, $p=0.19$;and texture $t(18)=1.15$, $p=0.26$were not significantly different between developed jam-cake and commercial cake. There was also no statistically significant difference in the mean hedonic scores of freshly prepared jam, and both ambient storage as well as refrigerator stored jam at the $p<0.05$ level. (Table-2).

Table 2. Sensory evaluation of Jackfruit Jam during storage

Particulars	Freshly prepared (0 day) (Mean±SD)	During storage (240 days)	
		Ambient Temp. (Mean±SD)	Refrigerated Temp. (Mean±SD)
Color	5.8±0.42	5.1±0.56	5.7±0.67
Aroma	5.9±0.73	5.8±0.63	5.9±0.73
Taste	6.1±0.56	5.5±0.52	5.7±0.82
Spreadability	5.1±0.56	5.2±0.42	5.1±0.73
Sweetness	5.7±0.67	5.4±0.51	5.8±0.78
Texture	5.1±0.56	5.3±0.48	5.2±0.63
Overall acceptability	5.6±0.51	5.3±0.48	5.5±0.52

Yeast and mold count of Jackfruit Jam: Developed jam was packaged using glass jar and stored in both ambient and refrigerated temperature for shelf-life evaluation. No growth of yeast and molds was observed at the beginning and end of 240 days in ambient as well as refrigerated temperature (Table -3).

Table 3. Yeast and mold count of Jackfruit Jam

Yeast and mold count (CFU/mL) in jackfruit jam			
Ambient temperature		Refrigerated temperature	
0 days	240 days	0 days	240 days
0	0	0	0

Conclusions

Jam is a popular food product in ready-to-eat foods. Based on the findings of the study, it can be inferred that jackfruit possesses a substantial amount of essential nutrients, encompassing both macro and micronutrients, even after undergoing processing into jam. The nutritional composition of Jam is of considerable importance for human growth, since it contains essential components such as total soluble solids and ascorbic acid content. The products were observed to maintain stability during storage at both ambient temperature and refrigeration for a duration of 8 months, as shown by the lack of significant changes in physico-chemical, sensory, and microbiological indices. The potential economic viability of using jackfruit jam into cake recipes is worthful. This is an opportunity to investigate the potential for creating additional value-added food items as a means of preserving the fruit during periods of low production and mitigating post-harvest losses. This study also reveals that jackfruit has high sensory qualities, making it appropriate for jams and other processed foods and increasing its market value. Therefore, this research endeavor has the potential to establish a novel domain for fortifying the food industry, therefore addressing the issues of unemployment and malnutrition in Bangladesh.

Author's contribution

M. M. Rahman and S. M. F. JINNAH executing and investigating of the research, M. M. Rahman and S.A. Rahman writing-review, editing and formal data analysis the original manuscript.

Conflicts of Interest

The authors declare no conflicts of interest regarding publication of this manuscript.

References

AOAC. 1995. Official Methods of Analysis (16th Ed.). Association of Official Analytical Chemists.

BBS (Bangladesh Bureau of Statistics). 2023. Yearbook of Agricultural Statistics of Bangladesh. Planning Division, Ministry of Planning, Peoples Republic of Bangladesh, Dhaka. pp.229.

Bhatia, B. S., Siddappa, G. S., and Lal, G. 1955. Composition and nutritive value of jack fruit. Indian *J. Agri. Sci.* 25:303-306.

Goswami, C., Hossain, M. A., Kader, H. A., and Islam, R. 2011. Assessment of physicochemical properties of jackfruits' (*Artocarpus heterophyllus* Lam) pulps. *J. Horti. Forestry Biotech.* 15(3):26-31.

Haque, M. N., Saha, B. K., Karim, M. R., and Bhuiyan, M. 2009. Evaluation of nutritional and physico-chemical properties of several selected fruits in Bangladesh. *Bangladesh J. Sci. and Industrial Res. 44*(3):353-358.

Eke-Ejiofor, J., and Owuno, F. 2013. The physico-chemical and sensory properties of jackfruit (*Artocarpus heterophilus*) jam. *Inter. J. Nutr. Food Sci. 2*(3):149-152.

Jagtap, U. B., Panaskar, S. N., and Bapat, V. A. 2010. Evaluation of antioxidant capacity and phenol content in jackfruit (*Artocarpus heterophyllus* Lam.) fruit pulp. *Plant Foods Human Nutr. 65*:99-104.

Mc-Clements, D. J., and Decker, E. A. 2009. Designing functional foods: measuring and controlling food structure breakdown and nutrient absorption. *Elsevier.*

Naeem, M. M., Fairulnizal, M. M., Norhayati, M. K., Zaiton, A., Norliza, A. H., Syuriahti, W. W., Azerulazree, J. M., Aswir, A. R., and Rusidah, S. 2017. The nutritional composition of fruit jams in the Malaysian market. *J. Saudi Soc. Agri. Sci. 16*(1):89-96.

Molla, M. M., Islam, M. N., Nasrin, T. A. A., and Karim, M. R. 2011. Assessment of postharvest losses of jackfruit in selected areas of Bangladesh. *Postharvest Manage. Horti. Crops, Annual Report,* HRC, BARI.

Mukprasirt, A., and Sajjaanantakul, K. 2004. Physico-chemical properties of flour and starch from jackfruit seeds (*Artocarpus heterophyllus* Lam.) compared with modified starches. *Inter. J. Food Sci. Tech. 39*(3):271-276.

NC, I., Okafor, D. C., and Adeboye, A. S. 2014. Sensory Evaluation of Jam Produced From Jackfruit (Artocarpus heterophyllus). *J. Agri. Veter. Sci*.

Siddappa, G. S. 1957. Development of products from jackfruit-canned jackfruit, frozen canned jackfruit and jackfruit jam. *J. Sci. Ind. Res*. *9*(11):166-99.

Singh, A., Kumar, S., and Singh, I. S. 1991. Functional properties of jack fruit seed flour. *Lebensmittel-Wissenschaft. Tech. 24*(4):373-374.

Susanta, K. R., and Joshi, G. D. 1995. Minor Fruits - Tropical. In S. S. K. D.K. Salunkhe (Ed.). *Handbook Fruit Sci. Tech.* 570-597.

Rana, M. S., Yeasmin, F., Khan, M. J., and Riad, M. H. 2021. Evaluation of quality characteristics and storage stability of mixed fruit jam. *Food Res. 5*(1):225-231.